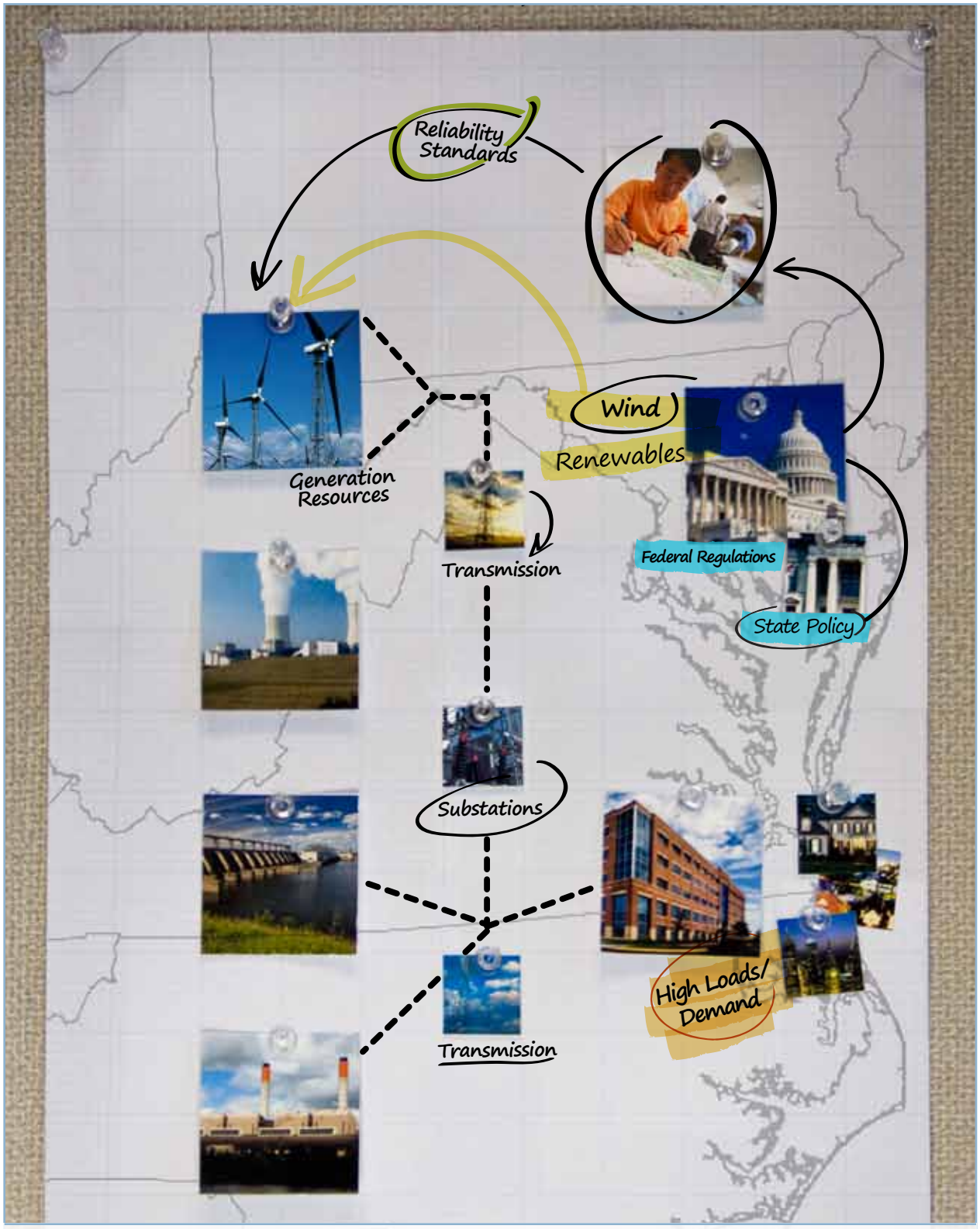
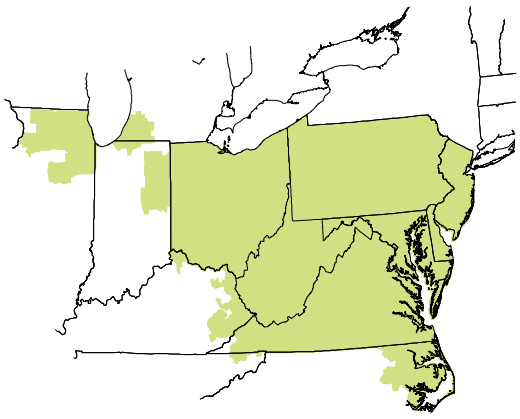


PJM Regional Transmission Expansion Planning Process

September 2010

Benefits of PJM's planning process



All options considered, not just new transmission

New generating plants, demand response and energy efficiency are important resources for meeting customers' electricity needs. PJM integrates new generation by developers and demand response and energy efficiency programs, to the extent these resources clear PJM market auctions. When PJM RTEP studies reveal that these resources are insufficient to serve load within established reliability standards, PJM proposes transmission upgrades to resolve identified violations of those standards.

PJM's primary responsibility is to ensure the reliability of the high voltage transmission system. Although PJM has a number of important tools at its disposal – including the ability to direct transmission owners to build transmission, PJM's powers are limited. For example, PJM is not able to direct or otherwise control the siting, capacity or timing of new generation.

Similarly, PJM cannot compel or otherwise control the design and implementation of demand response or energy efficiency programs. PJM can only order the reinforcement of transmission facilities to address reliability violations, through either the modification of existing transmission facilities – a frequent occurrence – or the construction of new transmission facilities.

Nearly $16 billion in improvements authorized

The PJM Board has authorized $16 billion of transmission upgrades and additions since the RTEP's inception in 1999, $13.2 billion of which is to maintain baseline reliability. New backbone lines at 500 kilovolt (kV) and 765 kV total $6.8 billion of this baseline amount. These large capability electricity conduits across PJM will ensure that electricity continues to flow reliably through 2025.

At the same time, $2.8 billion of transmission network and attachment facilities will reliably connect nearly 42,000 megawatts (MW) of new generating resources and more than 1,100 MW of merchant transmission capability.

By planning for future reliability needs on a region-wide basis rather than a utility-by-utility or state-by-state basis, PJM's RTEP process focuses on the most effective transmission upgrades to meet reliability criteria and promote greater market efficiency.

Transmission upgrades, additions maintain reliability

Fundamentally, imbalances between local electricity resources and consumer demand require transmission upgrades and additions to deliver electricity reliably.

New, multi-state high-voltage transmission lines are necessary to keep the lights on in 2011 and beyond. Without these new lines, PJM could be forced to take emergency operator action, including rotating power outages, in order to prevent much larger power system collapse, such as the blackout experienced by 50 million people in the eastern U.S. and Canada in 2003.

RTEP process attracts new generation

Since the inception of the generation interconnection process in 1999, PJM has received interconnection requests for 300,000 MW of new generation, from both traditional utilities and non-utilities, driven by market forces and PJM's transparent interconnection process.

Through July 2010, more than 660 projects were active or under construction in PJM's interconnection queues, totaling more than 78,000 MW.

These generation additions will enhance system reliability, power supply adequacy and competition among power suppliers.

Regional Transmission Expansion Planning

Planning tomorrow's grid today

PJM Interconnection's Regional Transmission Expansion Plan (RTEP) identifies transmission system additions and improvements needed to keep electricity flowing to 51 million people in 13 states and the District of Columbia.

PJM Interconnection engineers study regional power flows based on forecasted system conditions. Studies test the transmission system against mandatory national standards and PJM regional standards. These studies look 15 years into the future to identify transmission overloads, voltage limitations and other reliability standards violations.

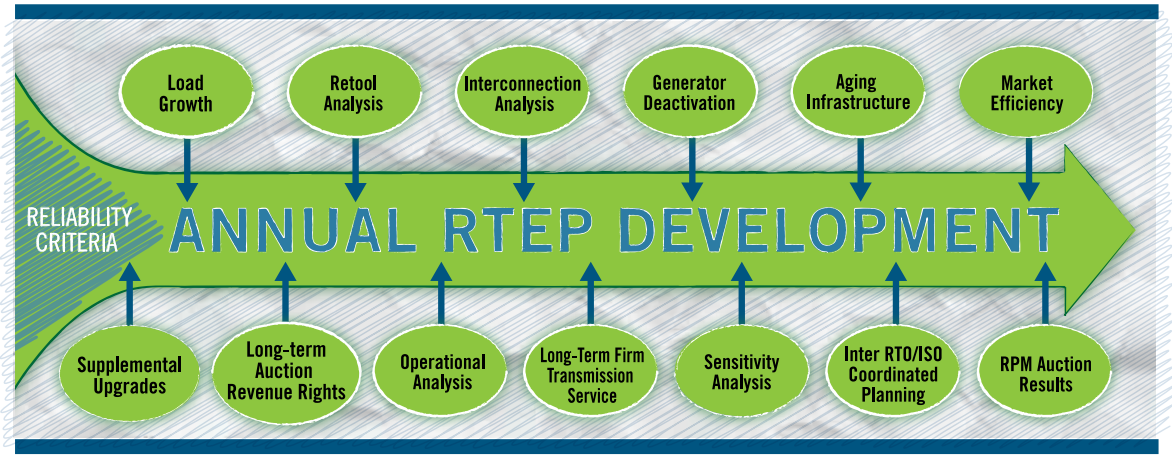
PJM is required to develop and implement a solution for each identified violation which could otherwise lead to overloads, equipment failure and black-outs. Working with stakeholders, solutions are examined for their feasibility and cost. This process culminates in one recommended plan – one Regional Transmission Expansion Plan (RTEP) – for the entire PJM footprint that is submitted to PJM's independent governing board for consideration and approval. Under contractual agreement, the board's approval then obligates transmission-owning utilities in PJM to build the facilities specified in the RTEP. This includes construction of new transmission lines and other facilities as well as upgrades to existing transmission assets.

Looking 15 years ahead

Approved by the Federal Energy Regulatory Commission (FERC), North American Electric Reliability Corporation (NERC) reliability standards are mandatory for utilities across the U.S. and explicitly require action for violations that occur over the ensuing ten years.

PJM's RTEP process includes both five-year and 15-year planning horizons. Five-year planning enables PJM to assess and recommend transmission upgrades to meet forecasted near-term load growth and to ensure the safe and reliable interconnection of new generation and merchant transmission projects.

A 15-year horizon allows PJM to consider the aggregate effects of many system trends, such as long-term growth in electricity use, generating plant retirements, broader generation development patterns (including the evolution of renewable resources) and demand response programs, to name but a few.



Planning process details

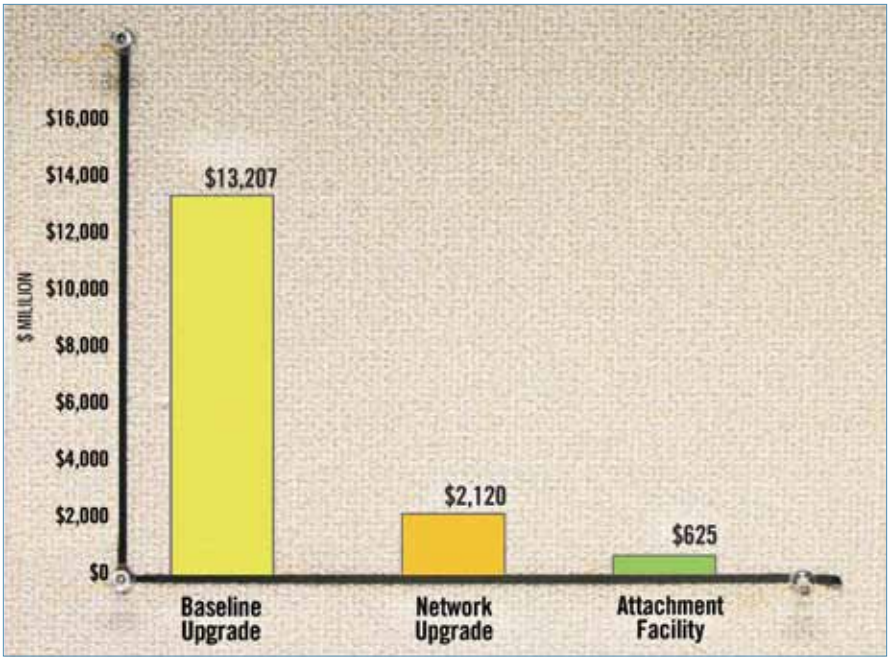
Following mandatory standards

Reliability criteria are mandatory standards that define acceptable power flows, voltage levels and other system stability limits. Through federal law, the North American Electric Reliability Corporation (NERC), Reliability First and SERC Reliability Corp. are authorized as independent organizations to establish and enforce reliability standards in the PJM area and elsewhere in the U.S. In addition, standards are set by nuclear plant license requirements. These standards ensure the grid's ability to withstand emergencies and deliver power reliably to customers.

PJM conducts a wide range of thermal and reactive tests over a 15-year horizon to comply with NERC standards. For each violation identified, PJM is required to develop and implement a solution. Subsequent annual RTEP analyses review the continuing need for identified upgrades.

Thermal vs. reactive violations

Thermal violations relate to the overheating of transmission facilities – power lines, transformers, etc. In PJM RTEP studies, thermal violations of NERC reliability standards are typically identified when power transfers simulated in RTEP studies are projected to cause a specific transmission facility to become "overloaded" if another facility is not in service. For example, one transmission line may be overloaded if a second line suddenly shuts down.



Reactive violations relate to maintaining adequate voltage levels necessary to support power flows across the transmission system reliably. In a sense, voltage "pushes" electricity through the system. Heavy power transfers cause bus voltages across PJM to decease, sometimes precipitously. Reactive criteria require that, following the loss of critical system elements such as a major transmission line, system voltage magnitudes and system voltage drops remain within prescribed limits. At its most severe, following the loss of a critical line or generator, voltage collapse can occur on heavily loaded systems, leading to system blackout.

NERC reliability standards require PJM to specify the "critical system conditions" against which the transmission system is evaluated. As part of its RTEP process power flow studies, PJM conducts this evaluation by means of generator deliverability and load deliverability test procedures. As part of these procedures, PJM engineers identify areas out of compliance with NERC standards and work with stakeholders to identify upgrades to solve each violation.

Deliverability studies: getting electricity where it's needed

PJM load deliverability and generator deliverability tests "stress" the PJM transmission system to ensure that transmission line power flows and bus voltages are within established limits.

PJM's **load deliverability** test examines each defined PJM sub-area under peak load conditions to determine the ability of the transmission system to deliver adequate power to the sub-area during a simulated emergency involving a generation capacity emergency shortage in the sub-area. If the deliverability test identifies a transmission overload then adequate levels of generating capacity cannot be delivered to serve customer load inside the area.

PJM's **generator deliverability** test evaluates the ability of the transmission system to deliver power from the generators in a given area to the rest of PJM under peak customer demand. If transmission constraints are identified, generation is said to be "bottled" inside the area and cannot be exported to customers in the rest of PJM.

Building and paying for RTEP transmission facilities

When transmission-owning parties join PJM, they sign the Transmission Owners Agreement (TOA). The agreement obligates them to build transmission facilities approved by PJM's independent board. Once approved, PJM monitors and coordinates construction in order to ensure that required deadlines are met.

Schedule 6 of PJM's Operating Agreement governs cost allocation. RTEP reliability facilities at 500 Kilovolts (kV) and above (and any underlying voltage facilities required to support such projects) are allocated to all PJM zones in proportion to load. RTEP reliability facilities under 500 kV are allocated to load serving entities (LSEs) in transmission zones causing the need for the facility.

Each transmission-owning entity in PJM establishes the revenue requirement for the transmission facilities it is required to build. Revenue requirements are approved by the FERC and filed as an Open Access Transmission Tariff (OATT) Attachment H, under the terms of OATT Schedule 12. PJM uses these Attachment H values to calculate PJM transmission service rates. PJM's market settlement process governs the distribution of transmission rate charges back to transmission owning entities themselves.

New generation and merchant transmission pay their costs

Generation and merchant transmission developers pay the costs to connect their projects to a local point on the grid. If broader transmission network enhancements beyond the point of interconnection are required, a developer is allocated a portion of additional costs to the extent that its project contributes to the overload driving the need for the upgrade. Developers must meet contractually specified financial and construction obligations so that required in-service dates can be met and so that PJM can continue to ensure reliable system operation. Interconnection of new generation and merchant transmission is governed by the terms of PJM's FERC-approved Open Access Transmission Tariff.

Trends affecting PJM planning

Many factors are driving the choice of fuel for new generation:

- **State renewable portfolio standards**
- **Incentives for new nuclear technologies**
- **Availability and price of natural gas**
- **Energy and capacity market economics**
- **Federal energy policy tax incentives to promote wind-powered generation**
- **Emerging environmental legislative and regulatory trends regarding NO_X, SO_X and CO_2 emissions.**

Proposed generation projects include wind at over 50 percent; natural gas at 27 percent; coal at 7 percent and nuclear at 8 percent. A generation portfolio of diverse fuel sources reduces system risk of over-relying on a single fuel.

The deactivation of a generator alters power flows that can cause transmission lines, transformers and other facilities to become overloaded.

"At Risk" generation affects transmission needs

"At risk" generators face the real possibility of deactivation given their ongoing economic viability driven by such factors as the increasing operating costs associated with age (some units are more than 40 years old) and changing environmental public policy, particularly with regard to carbon emissions.

Plant costs drive the ability of a plant to reap consistent revenue streams from energy, capacity and ancillary service markets. For example, one indication of an at risk plant is its inability to clear a capacity auction given its costs compared to other resources offered into the auction: other more efficient plants, renewable energy resources, demand response and energy efficiency programs, for example.

Addressing aging transmission facilities

PJM's planning process also assesses the risk of aging transmission infrastructure. Initially focused on an aging 500/230 kV transformer fleet, PJM will begin to examine aging 500 kV lines, some more than 40 years old. A number of them have been identified as constraints in recent RTEP deliverability analyses. Future transmission expansion plans will address the extent to which aging lines must be reconductored (i.e. new wires installed) or replaced to solve identified reliability criteria violations.

Considering market efficiency

PJM's RTEP process market efficiency analysis:

- **determines which reliability upgrades, if any, will have an economic benefit if accelerated or modified,**
- **identifies economic benefits associated with modifications to reliability-based enhancements already included in the RTEP that would relieve one or more economic constraints (Such upgrades, designed to resolve reliability issues are intentionally redesigned in a more robust manner to provide economic benefits, also.), and**
- **identifies new transmission upgrades that may result in economic benefits.**

A market simulation tool models hourly security -constrained economic dispatch results for a defined one-year period. PJM then compares results of simulations with and without specified baseline upgrades to assess their economic benefit in terms of market efficiency.

Prior to each RTEP cycle, PJM reviews key analytical parameters with stakeholders. Fuel costs, emissions costs, future generation scenarios, load forecasts and demand response projections are discussed.

Effects of Price Responsive Demand and Smart Grid technology

A growing number of states and utilities within PJM are pursuing demand response programs based on dynamic and time-differentiated retail prices and utility investments in Advanced Metering Infrastructure (AMI), often as part of smart grid initiatives. Such developments could potentially yield significant amounts of Price Responsive Demand (PRD), demand that predictably responds to changes in wholesale prices.

While PJM does not expect PRD to displace the overall future need for transmission additions, significant levels of PRD have the potential to provide system benefits.

For example, during periods of rising energy costs, PRD could slow the growth in peak demand. Doing so could defer the need for generation investment and potentially delay the need for certain transmission upgrades. RTEP process reliability analyses likely will require PJM to explore deliverability test changes to model PRD appropriately.

Public policy trends

An increasing focus by federal and state governments on climate change and energy independence continues to make clear the critical role of the transmission system.

For example, an important element of these policies is greater use of renewable resources, primarily wind. Integrating wind resources, often distant from the population centers that will use the electricity they produce, raises significant transmission public policy issues:

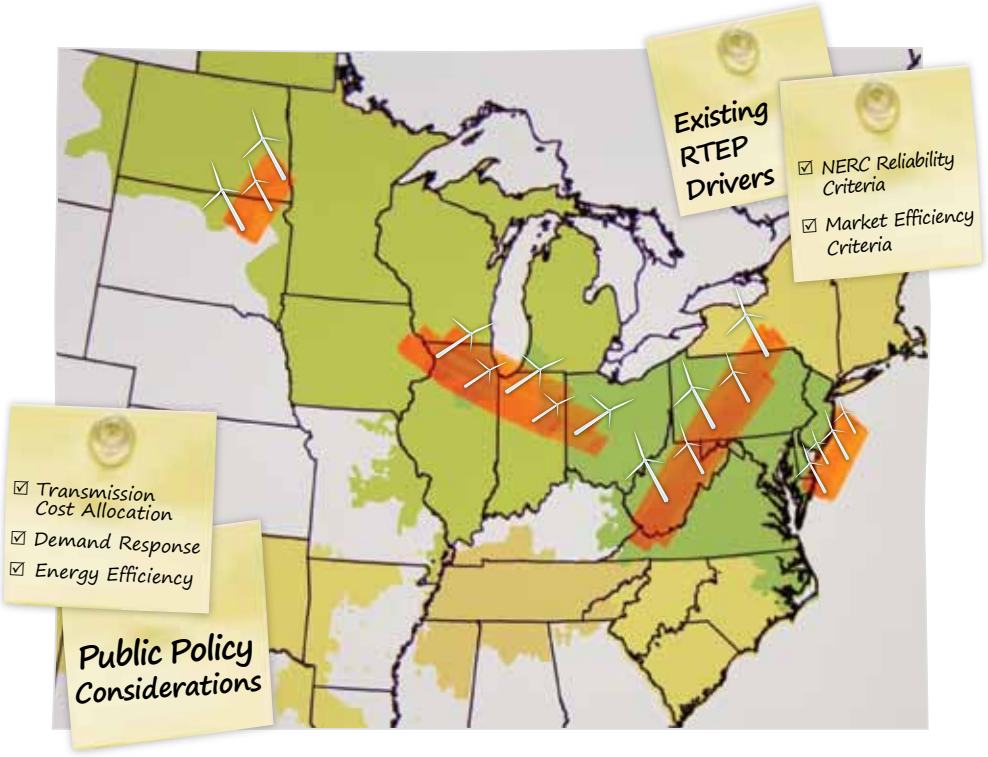
- **Impacts on reliability and economic efficiency across multiple regions**
- **Amounts of transmission that should be built, where it should be built and who should pay for it**

Renewable portfolio requirements

In PJM's footprint, nine states and the District of Columbia have adopted renewable portfolio standards (RPS), which require electricity suppliers to purchase specified amounts of renewable energy as part of their supply portfolio. Goals range from 12.5 percent in North Carolina to 25 percent in Ohio.

Much of the wind potential in PJM is clustered in three areas: along the Appalachian Mountains; in the Midwest, particularly in the Great Plains; and off the East Coast. Regardless of the location, new transmission will be needed to deliver that power to the population centers where it is to be used.

Active interconnection requests through July 31, 2010, total more than 38,000 MW of wind generation,185 MW of methane, 370 MW of biomass, 600 MW of hydro and 2,600 MW of solar.



Coordinating planning efforts with neighbors to address public policy objectives

Interregional electricity markets and system inter-operability require coordinated planning among PJM and its neighbors. PJM does so under contractual arrangements with the Midwest Independent System Operator, ISO New England, New York Independent System Operator, the Tennessee Valley Authority, Progress Energy and Duke Energy.

Several large interregional study efforts within the Eastern Interconnection are already addressing integration of renewables – primarily, the wide-scale integration of wind-powered generation. These efforts include the Eastern Interconnection Planning Collaborative (EIPC), the Eastern Wind Integration Transmission Study and the Joint Coordinated System Planning Study.

The EIPC initiative addresses the potential impact of a massive infusion of new renewable energy sources within the Eastern Interconnection. The EIPC creates a framework to conduct transmission analyses at the broader Eastern Interconnection level. Integral to this collaborative approach is the roll-up and analysis of existing regionally developed transmission plans. Moreover, processes for performing interregional analyses will help identify potential opportunities between regions to serve customers' electricity needs with greater market efficiency.

Cost allocation debate

While state and federal environmental mandates for greater amounts of wind and solar generation will require more transmission to deliver energy to customers reliably, deciding who pays the costs for new transmission lines remains a contentious industry issue.

The debate typically centers on the choice between "beneficiary pays" and "socialization," which have different meanings to different stakeholders. Generally, proponents of "beneficiary pays" argue that those parties benefitting from transmission should pay the costs of building transmission, with the implicit assumption that all benefits can be assigned to individual parties. Proponents of "socialization" argue that the most important benefits – reliability primary among them – cannot be assigned easily because all parties benefit and, thus, costs should be spread over all transmission system users.

PJM stakeholder process / Order 890

The activities of the PJM Transmission Expansion Advisory Committee (TEAC) and three sub-Regional RTEP Committees (mid-Atlantic, West and South), provide the primary stakeholder forums for ongoing exchange of ideas, discussion of issues and presentation of RTEP upgrades. The PJM Members Committee, Planning Committee, Reliability Committee, Transmission Owners Agreement Administrative Committee and Regional Planning Process Working Group also provide additional opportunities for stakeholder input on process issues.

PJM staff also engage federal and state regulatory bodies, including the Organization of PJM States Inc., to foster two-way communication and the resolution of planning issues.

PJM online RTEP resources

Additional Planning Process resources can be found online under the Planning Section of www.pjm.com:

1. **The most recent RTEP report, published annually**
2. **Activities of the TEAC, Sub-regional RTEP Committees and other stakeholder forums**
3. **The M-14 series of PJM manuals describing the specific business rules and study methodologies under which PJM conducts its planning process**
4. **PJM queues for generation and merchant transmission interconnection requests.**
5. **Construction Status Table of each RTEP upgrade approved by the PJM Board**
6. **The PJM Operating Agreement, Schedule 6, codifying PJMs' Regional Transmission Expansion Planning Process Protocol**
7. **The PJM Open Access Transmission Tariff, describing the interconnection request process for generating resource interconnection, non-utility (merchant) transmission interconnection as well as specific process provisions to address long-term firm transmission service and Auction Revenue Rights**

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